L 64284-65 EWT(1)/EWT(m)/EEC(k)-2/T/EWP(t)/

Fedorov, D. P.; Kuznetsov,

Leakage and noises in germanium transistors

Mezhvuzovskaya nauchno-tekhnicheskaya konferentsiya
(poverkhnostnyye i kontaktnyye yavleniya)
yavleniya v poluprovodnikakh

emitter junction, semi
P4 germanium transistor

The authors study the relationship between
lector junctions in P4 alloyed-junction germanium
effect of temperature on noises in these trans leakage
was used to determine the combined noise curr explain
measurement of the spectral distri
results are given. The experim
these trans

L 64284-65

ACCESSION NR: AT5020464

... nearly independent of the component of the ... thermal ... carriers. Orig. art. has ...

... OTHER: ...

Card

L 1133-66 EWT(1)/EEC(k)-2/T/EWA(h) IJP(c) GS
ACCESSION NR: AT5020479 UR/0000/64/000/000/0328/0334

AUTHORS: Kuznetsov, V. I.; Shchevelev, M. I.; Fedorov, D. P.
55,44 55,44 55,44

50
B+1

TITLE: Temperature dependence of parameters of plane silicon diodes
27

SOURCE: Mezhvuzovskaya nauchno-tekhnicheskaya konferentsiya po fizike poluprovodnikov (poverkhnostnyye i kontaktnyye yavleniya). Tomsk, 1962. Poverkhnostnyye i kontaktnyye yavleniya v poluprovodnikakh (Surface and contact phenomena in semiconductors). Tomsk, Izd-vo Tomskogo univ., 1964, 328-334
55,44

TOPIC TAGS: volt ampere characteristic, silicon diode, electric current / D202 diode, D205 diode
25,44

ABSTRACT: Results from experimental investigation of the temperature dependence of the back volt-ampere characteristics and break-through voltage of plane silicon high-voltage diodes of the type D202-D205 are reported. Parameters of the diodes were measured in the temperature interval of 20-170C. At low return voltages the current increases with the temperature, while at high voltages the opposite takes place, leading to the increase of the break-through voltage of the diode. Figure 1 on the Enclosure shows characteristic curves for the temperature dependence of the break-through voltage. It is concluded that two processes occur in silicon diodes, one of which leads to an increase in the return current with temperature,

Card 1/3

L 1133-66
ACCESSION NR: AT5020479

the other to a decrease. The first process is related to the generation of heat in the current carriers and is practically independent of the voltage on the transitions. The second process is connected with the surface changes occurring on the silicon oxide, due to the changes in concentration of chemisorbed moisture with temperature. To support this latter assumption, temperature dependence of 30 silicon transitions on the break-down voltage was recorded. The transitions were then dried for 8 hours in vacuum at 120C, then maintained in moist atmosphere for 5 days, each time recording $V_T(T)$. A detailed chemical explanation of the process is given. Orig. art. has: 4 figures.

ASSOCIATION: none

SUBMITTED: 06Oct64 ENCL: 01 SUB CODE: EC

NO REF SOV: 003 OTHER: 003

Card 2/3

L 1133-66

ACCESSION NR: AT5020479

ENCLOSURE: 01

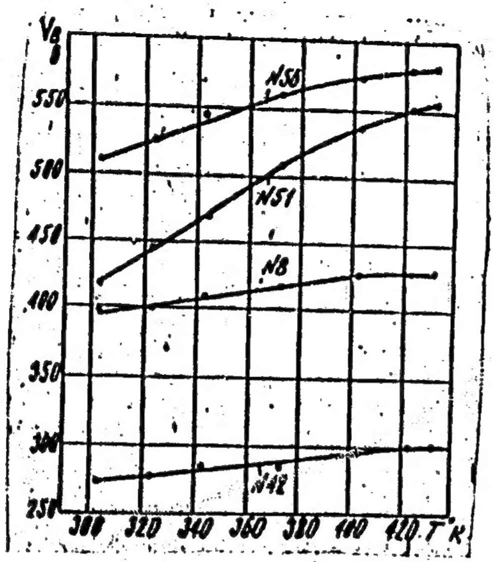

Fig. 1.

Card 3/3

FEDOROV, D. S.

Fedorov, D.S., Temperature regime of ocean currents as an indicator of their variability, Tr. Leningr. gidrometeorol. in-ta (Works of the Leningrad Hydrometeorological Institute), No 7, 1958, p 211-216; (RZhGeofiz 12/58-8872)

FEDOROV, D.T.(Chita)

All depots of the railroad became profit bringing units. Zhel.dor.transp. 45 no.2:73-74 F '63. (MIRA 16:2)

1. Glavnyy inzh. Zabaykal'skoy dorogi.
(Railroads—Freight)

ACCESSION NR: AP4017788 S/0085/64/000/002/0024/0025

AUTHOR: Fedorov, E.

TITLE: Satellites and weather forecasting

SOURCE: Kry*l'ya rodiny*, 15, no. 2, 1964, 24-25

TOPIC TAGS: meteorology, telemetering, weather satellite

ABSTRACT: Ground meteorological observatories have the disadvantages of being located unevenly over the surface of the earth, with large areas covered very poorly (especially water areas); being able to penetrate only the lower layers of the air, so that upper air soundings are too scanty to be of much use in weather forecasting; and are unable to transmit their observation data to central processing offices, in many cases, until they are too old to be of maximum value. Weather satellites would not be subject to these disadvantages. Images of cloud cover over extensive areas obtained from satellites are especially valuable for forecasting storms and cyclones. The heat balance of the earth is also easily measured from satellites, as are the atmospheric temperatures at various altitudes, the composition of the atmosphere, and the upper boundaries of cloud cover. Active radar tracking from satellites can

Card 1/2

ACCESSION NR: AP4017788

trace cloud movements and the nature of precipitation. Satellites may also be used as communication relay points for observation stations located in remote regions. Meteorological satellites should have orbits close to a polar orbit so that they can observe all latitudes of the globe. Orig. art. has 2 diagrams.

ASSOCIATION: none

SUBMITTED: 00 DATE ACQ: 11Mar64 ENCL: 00

SUB CODE: AS, CO NO REF SOV: 00 OTHER: 00

Card 2/2

L 35418-65 EEO-2/EWT(d)/FSF(h)/FSS-2/EWT(1)/FS(v)-3/EEC(k)-2/EWG(v)/EEC(t)/EEC(a)-2/

ACCESSION NR: AP5006235 EED-2/EWA(c)

signals from the cosmos. Guiding airplanes with the help of earth's artificial satellites

SOURCE: Kryl'ya rodiny, no. 2, 1965, 22-23

TOPIC TAGS: navigation satellite, navigation system, satellite network, aircraft guidance equipment

ABSTRACT: New vistas in the realm of airplane navigation are being opened by earth's artificial satellites. Angular coordinates ... the distance between ... may be ... signals ... calculated on the earth and beamed to the ... the orbit may be computed and corrected ... be circular and at a height of ...

L 35418-65

ACCESSION NR: AP5006235

navigation should involve 10 to 30 satellites. The apparatus in each satellite and in the plane must be so coordinated and synchronized that the plane's computer will calculate the coordinates, course, velocity, and altitude of the plane. In the future, not only planes but also near-earth space [illegible] satellite system. Orig. art. has: 3 figures.

ASSOCIATION: none

SUBMITTED: 00 ENCL: 00 SUB CODE: NG

NO REF SOV: 000 OTHER: 000

Card 2/2

FEDOROV, B.Ye.

Syenite intrusion in the Tuba and Syda Basins (Krasnoyarsk Territory).
Mat. VSEGEI Ob. ser. no.8:106-112 '48. (MIRA 11:4)
(Krasnoyarsk Territory--Syenites)

FEDOROV, E.Ye.

Devonian igneous activity in the Minusinsk Basin. Trudy VSEGEI 58:125-133 '61. (MIRA 15:5)
(Minusinsk Basin--Rocks, Igneous)

TRUNOV, A., glavnyy inzhener; REMENNYY, L., inzh.; FEDOROV, F., inzh.

Converting to central control system at the grain elevator of the Kirov Milling Combine. Muk.-elev.prom. 25 no.6:9-10 Je '59. (MIRA 12:9)

1. Leningradskiy mel'nichnyy kombinat im. S.M.Kirova (for Trunov).
2. Odesskiy proyektno-konstruktorskiy institut Pishcheprom (for Remennyy, Fedorov).

(Grain elevators--Equipment and supplies)
(Automatic control)

FEDOROV, F. A.

"Rationalization Serves Production," Tekst. prom., 12, No.4, 1952

APPROVED FOR RELEASE: 03/20/2001 CIA-RDP86-00513R000412620006-0"

FEDOROV, F. A.

"Mechanical Method for Removing Droppings from Under the Hackling Machine," Tekst. prom., 12, No.8, 1952

FEDOROV, F.A.

Device for planing grooved metal rollers for spinning looms.
Obm.tekh.opyt. [MLP] no.20:5-6 '56. (MIRA 12:11)
(Planing machines)

FEDOROV, F.A.

Addition of 300-200-brand cement to the BF-2 glue for increasing its strength. Obm.tekh.opyt.[MLP] no.20:19-20 '56. (MIRA 12:11)

(Glue)

FEDOROV, F.A.

Improved design of T-shaped brass clamps for fastening the R and D- system atomizers. Obm.tekh.opyt.[MLP] no.20:28-29 '56. (MIRA 12:11)

(Spraying)

FEDOROV, F.A.

Lap for repairing sliding calipers. Izm.tekh. no.3:12 Mr '63.
(MIRA 16:4)

(Calipers)

FEDOROV, F.F.

[redacted]

Duties of factory inspectors in controlling hoisting machinery. Bezop. truda v prom. 1 no.4:37 Ap '57. (MIRA 10:6)

(Hoisting machinery)

YEGORUSHKIN, V.Ye.; KRASHENINNIKOV, N.A.; RAZMYSLOVICH, I.R.; FEDOROV, F.F.; TSEKHANOVICH, P.V.; TSVYRKUN, N.A.; BUTYLIN, G., red.; KALECHITS, G., tekhn.red.

[Handbook of a tractor driver] Spravochnik traktorista. Minsk, Gos.izd-vo BSSR, Red.sel'khoz.lit-ry, 1959. 578 p. (MIRA 13:3)
(Highway transport workers--Handbooks, manuals, etc.)

GOLOVNEV, I.F., kand.tekhn.nauk; PANOV, A.A.; FEDOROV, F.F.; YUVACHEVA, N.Ya.; YELAGINA, T.A., tekhn.red.

[Press forging; bibliography with annotations for publications in 1957] Obrabotka metallov davleniem; annotirovannyi bibliograficheskii spravochnik literatury za 1957 god. Leningrad. No.1. [Heating and drop forging] Nagrev, kovka i goriachaia shtampovka. 1958. 132 p. (MIRA 13:2)

1. Leningradskiy dom nauchno-tekhnicheskoy propagandy.
(Bibliography--Forging)

VAYNTRAUB, D.A.; PANOV, A.A.; FEDOROV, F.F.; YUVACHEVA, N.Ya.; YELAGINA, T.A., tekhn.red.

[Press working of metals; annotated bibliography of publications for 1957] Obrabotka metallov davleniem; annotirovannyi bibliograficheskii spravochnik literatury za 1957 god. Leningrad. No.2. [Die stamping] Kholodnaia.shtampovka. Pt.1. 1959. 99 p. Pt.2. 1959. 77 p. (MIRA 13:3)

1. Leningradskiy dom nauchno-tekhnicheskoy propagandy. Nauchno-tekhnicheskaya biblioteka.
(Sheet-metal work)

REMENNYY, L.,inzh.; FEDOROV, F.,inzh.

Devices and equipment for the automatic control of various operations in grain elevators. Muk.-elev.prom. 25 no.2:8-10 F '59. (MIRA 12:4)

1. Odesskiy proyektno-konstruktorskiy institut Pishcheprom.
(Grain elevators) (Automatic control)

FEDOROV, F.I.

Theory of elastic waves in crystals. Comparison with an isotropic medium. Kristallografiia 8 no.2:213-220 Mr-Ap '63. (MIRA 17:8)

1. Institut fiziki AN BSSR.

FEDOROV, F. I.

Fedorov, F. I. - "On the superposition of physical magnitudes", Izvestiya Akad. nauk BSSR, 1949, No. 2, p. 17-18.

SO: U-411, 17 July 53, (Letopis 'Zhurnal 'nykh Statey, No. 20, 1949).

FEDOROV, F. I.

USSR/Physics - Relativity Wave Equation 11 Aug 51

"Minimum Polynomials of the Matrices of Relativistic Wave Equations," F. I. Fedorov, Belorussian State U imeni Lenin

"Dok Ak Nauk SSSR" Vol LXXIX, No 5, pp 787-790

Purpose is to show that the condition' which states that among the states possible for particles those must be absent corresponding to energy density equal to zero' also permits one essentially to limit the form of the minimum polynomials of the matrices of the following equation: $(g^a \Delta_a + ik)P=0$, where P represents the psi-function. Submitted by Acad V.A. Fok 16 Jun 51.

210T90

Fedorov, F. I. Generalized relativistic wave equations.

studied [Gel'fand and Yaglom, Žurnal Eksper. Teoret. Fiz. 18, 703–733 (1948); these Rev. 10, 583]. The author here considers, without giving a general analysis, when in a few special cases when γ is singular or all of the solutions

1942; these Rev. 4, 31]. F. J. Dyson

USSR/Physics - Crystallography, Optical Parameters 21 Jun 52

"Determining the Optical Parameters of Monoaxial Crystals According to Reflected Light," F. I. Fedorov, Belorussian State U imeni Lenin

"Dok Ak Nauk SSSR" Vol LXXXIV, No 6, pp 1171-1174

Subject investigation is based on the relations among the amplitudes of reflected and incident waves for the case of incidence of light from an isotropic medium on to a monoaxial nonconducting nonmagnetic crystal. Designates the unit vectors of the wave normals of the incident reflected, ordinary and extraordinary waves; vectors of the elec and magnetic

223T102

fields; indices of refraction of the isotropic medium; ordinary and extraordinary rays; unit vector of optical axis of crystal; tensor of dielec permeability; unit vector of normal to the surface of sepn. Submitted by Acad D. S. Belyankin 24 Apr 52.

223T102

FEDOROV, F. I.

FEDOROV, F.I.

Use of the method of functionals in certain problems of radiation theory. Uch. zap. LGU no.146:33-73 '52.
(Quantum theory) (MIRA 11:3)

FEDARAU, F.I.

NEKRASHEVICH, I.G., kandidat fizika-matematychnykh navuk, redaktor; FEDARAU, F.I., kandydat fizika-matematychnykh navuk, redaktor; ALEKSANDROVICH, Kh., tekhredaktar.

[Radio and its role in the development of culture and technical progress] Radyio i iaho rolia u razvitstsi kul'tury i tekhnichnaha pragresu. Minsk, Vyd-va AN BSSR, 1953. 30 p. (MLRA 8:2)
(Radio)

FEDOROV, FEDOR IVANOVICH

FEDOROV, Fedor Ivanovich

FEDOROV, Fedor Ivanovich (Belorussian State U imeni Lenin), Academic Degree of Doctor of Physico-Mathematical Sciences, based on his defense, 3 December 1954, in the Council of the State Order of Lenin Optical Inst imeni Vavilov, of his dissertation entitled: "Invariable methods in the optics of anisotropic mediums." For the Academic Degree of Doctor of Sciences.

SO: Byulleten' Ministerstva, Vysshego Obrazovaniya SSSR, List No 20, 8 October 1955, Decision of Higher Certification Commission Concerning Academic Degrees and Titles.

FEDARAU,F.I.

Invariable indications of the polarization of light. Vestsi AN BSSR no.6:78-91 N-D '54. (MIRA 8:9)

(Polarization (Light))

FEDOROV, F. I.

USSR/Physics - Elect. magn. wave polarization

Card 1/2 Pub. 22 - 17/49

Authors : Fedorov, F. I.

Title : About the polarization of electro-magnetic waves

Periodical : Dok. AN SSSR 102/1, 69-71, May 1, 1955

Abstract : An analysis of electro-magnetic wave polarization is presented. Monochromatic homogeneous and non-homogeneous waves are considered. Two methods for analyzising the homogeneous waves are suggested. The first method starts from a consideration of the wave amplitude in the form $E_o = E_1 + iE_2$, where the real vector parts E_1 and E_2 are conjugated semi-diameters of the ellipse of oscillations. The second method consists in the consideration of the complex vector $E = E_o e^{i\varphi}$, where φ is a phase

Institution : The Acad. of Sc., USSR, Physico-Technical Institute

Presented by : Academician A. A. Lebedev, December 13, 1954

Card 2/2 Pub. 22 - 17/49

Periodical : Dok. AN SSSR 102/1, 69-71, May 1, 1955

Abstract : of the oscillations. A consideration of the non-homogeneous wave polarization is suggested, starting with the reduction of Maxwell's equation to the following form:

$$\varepsilon E = -[mH], \quad \mu H = [mE].$$

As a result of such a treatment of Maxwell's equation a series of properties of non-homogeneous electro-magnetic waves is listed. Two references: 1 USSR and 1 Germ. (1929 and 1952).

FEDOROV, F.I.

USSR/Physical Chemistry - Crystals. B-5

Abs Jour: Referat. Zhurnal Khimiya, No 3, 1958, 7082.

Author : F.I. Fedorov.
Inst :
Title : "Transfer Principle" and General Theory of Optical Properties of Absorbing Crystals.

Orig Pub: Optika i spektroskopiya, 1956, 1, No 6, 807-808.

Abstract: The lack of foundation for the "transfer principle" is emphasized. According to this principle, all the relations of optics of transparent crystals may be transferred to the cases of absorbing media (comprising monoclinic and triclinic crystals) on condition that corresponding magnitudes receive complex values. Cited computations show that the tensor of dielectric permeability has not generally three own linearly independent vectors, it has not even complex vectors, consequently, the theory based on the "transfer principle" cannot be applied to

Card : 1/2

Inst. Physics & Mathematics AS BSSR

FEDOROV, F.I.

Determining the optical parameters of absorbing crystals. Izv.AN SSSR Ser.fiz.no.5:564-569 '56. (MIRA 9:9)

1.Institut fiziki i matematiki Akademii nauk BSSR.
(Crystallography)

Fedorov, F.I

USSR/Theoretical Physics B-6

Abs Jour : Referat Zhur - Fizika, No 5, 1957, No 10898

Author : Fedorov, F.I.

Inst : Institute of Physics and Mathematics, Academy of Sciences, Belorussian, SSR.

Title : Reduction of Wave Equations for Spin Zero and One to the Hamiltonian Form.

Orig Pub : Zh. eksperim. i teor. fiziki, 1956, 31, No 1, 140-142

Abstract : A method is given for the reduction of the equation for particles with spins zero and one

$$(\beta_k \nabla_k + \varkappa)\psi = 0 \qquad (1)$$

to the Hamiltonian form. The method is independent of the actual choice of matrixes β_k and is based only on Eq. (1)

Card 1/2

FEDOROV, F.I.

Certain dot-product representations of three-dimensional tensors. Trudy Inst.fiz. i mat. AN BSSR no.2:230-234 '57. (MIRA 12:1)

(Calculus of tensors)

AUTHOR: Fedorov, F.I.

51-3-12/24

TITLE: Optics of magnetic crystals. II. Binormals and biradials. Optical surfaces. (Optika magnitnykh kristallov. II. Binormali i Biradiali. Opticheskiye Poverkhnosti).

PERIODICAL: "Optika i Spektroskopiya" (Optics and Spectroscopy), 1957, Vol.2, No.3, pp. 361-370 (U.S.S.R.)

ABSTRACT: Continuation of the author's paper in "Optika i Spektroskopiya", Vol.1, p.926, 1956. Theoretical electromagnetic calculations give directions of binormals in a general type of magnetic crystal. It is found that, in general, transparent magnetic crystals (just like non-magnetic ones) have two binormals. A principle of duality, i.e. parallelism of the systems of equations, is established for normals and rays in infinite magnetic crystals. Binormal and biradial surfaces are found to be, in general, different. The limiting values of the refractive indices are obtained. The optical normal surface and its cross-sections are derived and shown in figures. There are 5 figures; 3 references (2 Slavic); a mathematical appendix (matrices and tensors).

Card 1/1

SUBMITTED: June 2, 1956.

ASSOCIATION: Physics and Mathematics Institute, Ac.Sc. of Byelorussian SSR (Institut Fiziki i Matematiki Ak.Nauk BSSR).

AVAILABLE:

AUTHOR: Fedorov, F.I. 51-4-17/25

TITLE: Optics of magnetic crystals. III Uni-axial and uni-refringent magnetic crystals. (Optika magnitnykh kristallov. III Odnoosnyye i odnoprelomlyayushchiye magnitnyye kristally).

PERIODICAL: "Optika i Spektroskopiya" (Optics and Spectroscopy) 1957, Vol.2, No.4, pp.514-523 (U.S.S.R.)

ABSTRACT: This purely theoretical paper is the continuation of the author's papers in Optika i Spektroskopiya, Vol.1, p.926, 1956 and Vol.2, p.361, 1957. The electromagnetic theory of wave propagation is applied here to particular cases of magneto-anisotropic media. Uni-axial magnetic crystals, defined as those which possess a unique axis along which both normal velocities are identical, are considered. Optical surfaces are derived and illustrated for these crystals. It is established that, in general, in uni-axial magnetic crystals: (a) binormals do not coincide with biradials; (b) ray velocity along a biradial is not equal to normal velocity along a binormal. It is shown, in principle, that there also exists a group of anisotropic magnetic crystals for which birefringence is absent (they are called uni-refringent). In other words in such crystals light velocity depends on direction but has only one value for each direction. Linear polarization

Card 1/2

AUTHOR: Fedorov, F.I.

51-5-10/26

TITLE: Optics of the Absorbing Crystals. (Optika pogloshchayushchikh kristallov) I. General Relationships. (I. Obshchiye sootnosheniya)

PERIODICAL: Optika i Spektroskopiya, 1957, Vol.2, No.5, pp. 616 - 622 (USSR).

ABSTRACT: The fundamentals of the optical theory of the absorbing crystals were given by Voigt and Drüde at the end of the last and beginning of the current centuries. Their theory, however, is not absolutely general since it has limitations due to using a special system of co-ordinates, the so-called "principal axes" of the complex tensor of dielectric permittivity. This theory is also very complicated and leaves certain important questions un-answered. In the current paper (which is to be followed by further parts), a fully-general theory of the optical properties of the absorbing crystals is developed on a new invariant basis and this new theory is free of many limitations of the Voigt and Drüde theory.

Starting from Maxwell's electro-magnetic equations, general relationships are put forward for propagation of plane, in particular, non-uniform, waves in the absorbing crystals. A general equation for normals in an invariant form is obtained.

Card 1/2

Optics of the Absorbing Crystals.

51-5-10/26

... for linear and circular polarisation of waves are discussed. The directions of the wave-field vectors are determined for a given vector of refraction. The paper is entirely mathematical. There are 8 references, of which 5 are Slavic.

ASSOCIATION: Institute of Physics and Mathematics of the Ac.Sc. Belorussian SSR. (Institut Fiziki i Matematiki AN BSSR)

SUBMITTED: July 6, 1956.

AVAILABLE: Library of Congress

Card 2/2

AUTHOR: Fedorov, F. I. 51-6-13/26

TITLE: Optics of Absorbing Crystals. II. Crystals of Middle Syngonies. (Optika pogloshchayushchikh kristallov II. Kristally srednikh singoniy.)

PERIODICAL: Optika i Spektroskopiya, 1957, Vol.II, Nr.6, pp. 775-780. (USSR)

ABSTRACT: A theoretical paper. Optical properties in an invariant form are discussed for absorbing crystals of trigonal, tetragonal and hexagonal syngonies. General equations are obtained for the refractive vector and for field vectors of the ordinary and extra-ordinary waves. Both uniform and non-uniform waves are treated. The conditions for linear and circular polarisation of waves are given. In uniaxial absorbing crystals for uniform waves polarisation properties are obtained similar to those of transparent uniaxial crystals. It is found that absence of double refraction occurs in absorbing uniaxial crystals not just for a single direction of the incident of wave, as in transparent uniaxial crystals, but for a range of directions.

Card 1/2

51-6-13/26

Optics of Absorbing Crystals. II. Crystals of Middle Syngonies.

There are 4 references, all of which are Slavic.

ASSOCIATION: Institute of Physics and Mathematics, Academy of Sciences of the Byelorussian SSR. (Institut fiziki i matematiki AN BSSR)

SUBMITTED: July 6, 1956.

AVAILABLE: Library of Congress.

Card 2/2

FEDOROV, F.I.

FEDARAU, F.I.; SUPRUNENKA, D.A.; NEKRASHEVICH, I.G.

History of development of physicomathematical sciences in White Russia. Vestsi AN BSSR Ser. fiz.-tekh. nav. no.3:17-20 '57. (MIRA 11:1)

(White Russia--Physics)
(White Russia--Mathematics)

FEDOROV, F.I.

Light reflection and refraction laws in a vector form. Uch.zap. BGU no.32:169-182 '57. (MIRA 11:12)
(Light)

APPROVED FOR RELEASE: 03/20/2001 CIA-RDP86-00513R000412620006-0"

PHASE I BOOK EXPLOITATION 663

Fedorov, F. I.

Optika anizotropnykh sred (Optics of Anisotropic Media) Minsk, Izd-vo AN BSSR, 1958. 379 p. 2,000 copies printed.

Ed.: Stepanov, B. I., Prof.; Ed. of Publishing House: Barmichev, V. Tech. Ed.: Aleksandrovich, Kh.

PURPOSE: This book is intended for the use of students and specialists in the field of optics with special emphasis on anisotropic media.

COVERAGE: This book is a presentation of the phenomenological electromagnetic theory of light propagation in homogeneous, mainly anisotropic,media. It also covers the theory of reflection and refraction of light on the surface of these media. The first three chapters contain well known results, but many of them are obtained by methods different from the ones employed in available works in theoretical optics. Along the same lines chapters I, II, and III present a series of new results concerning polarization, heterogeneous waves, total reflection, etc. The majority of results presented in chapters IV, V, and VI are said to be original. Pertinent mathematical relations are found in paragraph 4 of chapter I, and paragraphs 16 and 20 of chapter III.

Card 1/6

Some are also found throughout chapters V and VI. Recognition is given to Professor B. I. Stepanov for his invaluable advice and observations and to B. V. Bokut' for his help in reading the manuscripts and getting the book ready for the printers. There are 210 references, 72 of which are Soviet, 104 German, 25 English, 8 French and 1 Swedish.

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AVAILABLE: Library of Congress

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10-15-58

FEDOROV, F.I.

Reflection and refraction of light in biaxial crystals. Inzh.-fiz.zhur. no.1:41-52 Ja '58. (MIRA 11:7)

1. Institut fiziki i matematiki AN BSSR, g.Minsk.
(Crystallography)

FEDOROV, F.I.

Composition of parameters of a rotation group. Dokl.AN BSSR 2 no.10:408-412 N '58. (MIRA 12:8)
(Groups, Theory of)

SOV/70-3-1-8/26

AUTHOR: Fedorov, F.I.

TITLE: Invariant Methods in the Optics of Transparent Non-magnetic Crystals (Invariantnyye metody v optike prozrachnykh nemagnitnykh kristallov)

PERIODICAL: Kristallografiya, 1958, Vol 3, Nr 1, pp 49 - 56 (USSR)

ABSTRACT: According to the electromagnetic theory of light, the optical properties of non-magnetic crystals are determined by the symmetric dielectric constant tensor, ε. Usually a special system of co-ordinates is used in the case of such crystals, so that this tensor assumes a diagonal form. However, in spite of the fact that it is widely used, this method is neither unique nor the best for solution of problems in the optics of anisotropic media. Invariant vector-tensor methods which do not employ any special co-ordinate systems have considerable advantages. The author has shown in Refs 1 and 2 that the latter methods may be used to develop a general theory of the optical properties of media having an arbitrary magnetic anisotropy and absorption anisotropy. A particularly useful simplification of the theory is obtained by the use of special invariant dyadic representations

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SOV/70-3-1-8/26

Invariant Methods in the Optics of Transparent Non-magnetic Crystals

for 3-dimensional tensors. The present work is concerned with the application of the methods developed in Ref 3 by the present author to some of the main problems in the optics of transparent non-magnetic crystals. The second section of the present paper (Section 1, is an introduction) is concerned with the definition of a "canonical" representation of a tensor. Such a representation is defined by Eq (3). Section 3 treats uniaxial crystals. The "canonical" tensor representation is applied to derive the usual properties of plane, monochromatic waves ($\mu = 1$) in tri-, tetra- and hexagonal crystals. Section 4 deals with biaxial crystals and again the "canonical" representation formalism is applied and among other things, it is shown that the biradials of the crystal coincide with the axes of the dielectric constant tensor, or the binormals of a non-magnetic transparent crystal are the axes of the inverse dielectric constant tensor ε^{-1}. The final section deals with optical surfaces and it is shown that invariant methods may lead to the usual results in a much simpler way. In general, even in the case of the simpler problems in the optics of anisotropic media, there is no

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Invariant Methods in the Optics of Transparent Non-magnetic Crystals

necessity to use any special system of axes since the invariant approach is both more general and simpler. There are 5 Soviet references, 1 of which is a translation from German.

ASSOCIATION: Institut fiziki i matematiki AN BSSR (Institute of Physics and Mathematics, Ac.Sc. Belorussian SSR)

SUBMITTED: January 15, 1957

Card 3/3

AUTHOR: Fedorov, F.I. 70-3-3-11/36

TITLE: On Certain General Regularities in the Reflection of Light from Crystals (O nekotorykh obshchikh zakonomernostyakh pri otrazhenii sveta ot kristallov)

PERIODICAL: Kristallografiya, 1958, Vol 3, Nr 3, pp 322 - 324 (USSR).

ABSTRACT: It has been theoretically established that on the reflection of light from a crystal of any type (transparent, absorbing, magnetic, etc.) for every given direction of the wave normal of the incident wave, there exists a unique pair of mutually perpendicular directions of polarisation of the incident wave, to which correspond two mutually perpendicular directions of polarisation of the reflected wave. For these polarisation conditions, the coefficients of reflection assume the maximum and minimum values. It is assumed that the relations between $\underline{D}$ and $\underline{E}$ and $\underline{B}$ and $\underline{H}$ are linear. The results follow directly from an analysis of Maxwell's equations. The reflected wave has a magnetic vector $\underline{H}'$ connected with the magnetic vector of the incident wave $\underline{H}$ by $\underline{H}' = R\,\underline{H}$ (R being a matrix). $R+$ is the Hermitian conjugate to R. The reflected energy is $H'^{*}H'$ and the coefficient of reflection

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70-3-3-11/36

On Certain General Regularities in the Reflection of Light from Crystals

$= r = /H'/^2 \; / \; /H/^2 \; . \; /H'/^2 = H^*R^+RH = H^*TH$ where $T = R^+R = T^+$ is the Hermitian self-conjugate matrix. If $/H/^2$ is made 1 then $r = H^*TH$. The task is to find the extrema of the Hermitian quadratic form $r(H) = H^*TH$ with the supplementary condition $H^*H = 1$. As is known the vectors H corresponding to the extrema correspond to vectors of the matrix T of the Hermitian form. As these vectors H and H' are each determined by two complex components in corresponding phase planes, the matrix T then has two rows and two columns and consequently the two corresponding vectors H_1 and H_2 are determined by the conditions $TH_1 = r_1H_1$ and $TH_2 = r_2H_2$ where r_1 and r_2 denote the corresponding special values of the matrix T. From this it is deduced that $H_1'^*H_2' = r_2H_1^*H_2 = 0$.

The following conclusions are drawn:

1) For light falling from an isotropic medium (non-conducting) onto an arbitrary medium for a given direction of the wave normal of the incident wave, there exists one

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70-3-3-11/36

On Certain General Regularities in the Reflection of Light from Crystals

and only one pair of magnetic vectors H_1 and H_2, connected by $H_1^* H_2 = 0$, which correspond to a pair of vectors for the reflected wave H_1' and H_2' which are connected by $H_1'^* H_2' = 0$.

2) These vectors are eigen vectors of the Hermitian matrix T.

3) They correspond to extrema of the reflection coefficient.

4) For the usual case of reflection from a transparent medium T and H_1 and H_2 are real.

5) If H_1 and H_2 are non-linear then the maximm reflection will be obtained for elliptically polarised incident waves.

6) For total reflection R must be a unitary matrix.

7) For reflection from isotropic media H_1 and H_2 are linear and together with H_1' and H_2', the incident ray and its perpendicular lie in a plane.

Card3/4 There are 6 references, 3 of which are Soviet and 3 German.

70-3-3-11/36

On Certain General Regularities in the Reflection of Light from Crystals

ASSOCIATION: Institut fiziki i matematiki AN BSSR (Institute of Physics and Mathematics, AS BSSR)

SUBMITTED: October 30, 1957

Card 4/4

SOV/70-3-5-9/24

AUTHORS: Goncharenko, A.M. and Fedorov, F.I.

TITLE: The Surfaces of Refraction and Absorption in Absorbing Crystals (Poverkhnosti refraktsii i absorbtsii pogloshchayushchikh kristallov)

PERIODICAL: Kristallografiya, 1958, Vol 3, Nr 5, pp 587-592 (USSR)

ABSTRACT: A theoretical analysis is made of some of the properties of the surfaces representing the refractive index and absorption in absorbing crystals. Only the propagation of uniform waves is considered where wave and amplitude normals are parallel. The refractive index surface is defined by a radius vector $\underline{r}_1$ of length proportional to the r.i. n_1 for the wave normal direction $\underline{n}$. Hence, $\underline{r}_1 = n_1 \underline{n}$ and n_1 is the real part of the r.i., $n = n_1 - in_2$, n_2 being the absorption coefficient. The absorption surface is defined by $\underline{r}_2 = n_2 \underline{n}$. The task is to describe these two surfaces as functions of the wave normal $\underline{n}$.
The coefficients in the expression:

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SOV/70-3-5-9/24

The Surfaces of Refraction and Absorption in Absorbing Crystals

$$n_{\pm}^{-2} = a + b\,[nc'][nc''] \pm b\left([nc']^2\,[nc'']^2\right)^{1/2}$$

have to be found. The parameters come from the reciprocal complex tensor for the dielectric susceptibility:

$$\varepsilon'^{-1} = a + b(c'.c'' + c''.c') .$$

A graphical method for finding the directions of the extrema in principal sections of both the r.i. and the absorption surfaces is explained. Explicit values for the parameters in the above equation are given in terms of the real and imaginary parts of the r.i. and the directions are given. There are 2 figures and 4 references, 3 of which are Soviet and 1 German.

Card 2/3

SOV/70-3-5-9/24

The Surfaces of Refraction and Absorption in Absorbing Crystals

ASSOCIATION: Institut fiziki i matematiki AN BSSR (Institute of Physics and Mathemtics of the Ac.Sc. Belorussian SSR)

SUBMITTED: March 17, 1958

Card 3/3

Fedorov, F.I.

AUTHORS: Fedorov, F. I. and Tomil'chik, L. M. 51-4-1-20/26

TITLE: On the Theory of the Optical Properties of Biaxial Magnetic Crystals. (K teorii opticheskikh svoystv dvuosnykh magnitnykh kristallov.)

PERIODICAL: Optika i Spektroskopiya, 1958, Vol. IV, Nr. 1, pp. 109-112. (USSR)

ABSTRACT: F. I. Fedorov (Refs. 1-4) developed a theory of the optical properties of magnetic crystals in an invariant form. From this theory he deduces the main laws of propagation of light in magnetic crystals of all syngonies. In the case of biaxial crystals the problem was complicated by the presence of two non-commuting tensors ε and μ. The theory can be considerably simplified by using a special "canonical" dyadic representation of tensors. In Ref.5 such a representation of the symmetric tensor ε was applied to the case of transparent non-magnetic crystals. In

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the case of magnetic biaxial crystals, the optical properties depend greatly on the non-symmetric tensor $\gamma = \varepsilon^{-1}\mu$. A canonical dyadic representation for the latter tensor was obtained in Ref.6. The present (entirely theoretical) paper gives the main optical relationships for transparent magnetic biaxial crystals. There are 6 references, all of which are Russian.

ASSOCIATION: Belorussian State University imeni V.I. Lenin. (Belorusskiy gosudarstvennyy universitet im. V.I. Lenina.)

SUBMITTED: April 17, 1957.

AVAILABLE: Library of Congress.

1. Magnetic crystals-Biaxial-Optical properties

FEDOROV, F.I.

51-4-3-13/30

AUTHORS: Sotskiy, B.A., and Fedorov, F.I.

TITLE: Molecular Theory of Reflection and Refraction of Light. I. Light Incident from Vacuum onto an Isotropic Medium. (K molekulyarnoy teorii otrazheniya i prelomleniya sveta. I. Padeniye sveta iz vakuuma na izotropnuyu sredu.)

PERIODICAL: Optika i Spektroskopiya, 1958, Vol.IV, Nr.3, pp. 365-372 (USSR).

ABSTRACT: Molecular theory of propagation and refraction of light in isotropic media was developed by Ewald, Esmarch, Oseen, Lundblad and others (Refs.1-18). This theory is based on the following assumptions. Under the action of an electromagnetic wave, incident from vacuum onto the medium, molecular dipoles are excited into a state of degenerate vibrations and emit secondary waves. Both the incident and secondary waves obey Maxwell's equations for vacuum. Superposition of all the secondary waves and of the incident wave gives the refracted wave inside the medium, and the reflected wave outside it. This molecular theory has a number of faults of fundamental nature. Thus Fresnel's

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51-4-3-13/30

Molecular Theory of Reflection and Refraction of Light. I.

formulae for the general case of oblique incidence are obtained only in approximate form by using the method of Oseen and Lundblad (Ref.10-12). In none of the papers on the molecular theory of reflection and refraction is the case of total reflection of light dealt with. The present paper is an attempt to develop a more complete and exact molecular theory of reflection and refraction, including in particular the case of total reflection. All the main relationships (such as the relationship between the refractive index and polarizability, the quenching theory of Oseen, Fresnel's formulae) are obtained exactly and in a comparatively simple way. The present authors also generalize Oseen's theory to the case of non-homogeneous waves. The paper is entirely theoretical. There are 2 figures and 21 references, of which 14 are German, 4 Soviet, 2 English and 1 a translation of Born's "Optics" into Russian.

ASSOCIATION: Belorussian State University (Belorusskiy gosudarstvennyy universitet.)

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Molecular Theory of Reflection and Refraction of Light. I. 51- 4 -3-13/30

SUBMITTED: May 4, 1957.

1. Light--Reflection--Theory 2. Light--Refraction--Theory
3. Light--Propagation--Theory

Card 3/3

AUTHORS: Sotskiy, B.A. and Fedorov, F.I. SOV/51-5-1-10/19

TITLE: On the Molecular Theory of Reflection and Refraction of Light. (K molekulyarnoy teorii otrazheniya i prelomleniya sveta) II. Light Incident on the Boundary Between an Isotropic Medium and Vacuum or Another Isotropic Medium. Total Reflection. (II. Padeniye sveta na granitsu izotropnoy sredy s vakuumom ili s drugoy izotropnoy sredoy. Polnoye otrazheniye)

PERIODICAL: Optika i Spektroskopiya, 1958, Vol 5, Nr 1, pp 57-65 (USSR)

ABSTRACT: In the preceding part of this work (Ref 1) the authors considered the case of an infinite plane monochromatic electromagnetic wave incident from vacuum on to an isotropic medium. The present paper gives the molecular theory of reflection and refraction of light at the boundary of two media, of which the first consists of molecular dipoles and the second is vacuum or consists of dipoles of another type. The molecular theory of total reflection is given. It is found that, under certain conditions, the vacuum wave which

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SOV/51-5-1-10/19

On the Molecular Theory of Reflection and Refraction of Light. II. Light Incident on the Boundary Between an Isotropic Medium and Vacuum or Another Isotropic Medium. Total Reflection.

appears as the result of superposition of primary waves produced by vibrations of dipoles, may be damped in spite of the fact that the dipole vibrations are undamped. This is the converse of the case discussed in Part I (Ref 1) where a damped dipole wave produced an undamped vacuum wave. There are 3 figures and 5 references, 2 of which are Soviet, 1 translation of a Western work into Russian, 1 German and 1 English.

ASSOCIATION: Belorusskiy gosudarstvennyy universitet (Belorussian State University)

SUBMITTED: August 15, 1957

Card 2/2

1. Light - Reflection 2. Light - Refraction 3. Light - Molecular theory

AUTHOR: Fedorov, F.I. SOV/51-5-3-17/21

TITLE: Optics of Absorbing Crystals. (Optika pogloshchayushchikh kristallov). III. Crystals of Lower Syngonies. Optical Axes (III. Kristally nizshikh singoniy. Opticheskiye osi).

PERIODICAL: Optika i Spektroskopiya, 1958, Vol 5, Nr 3, pp 322-333 (USSR)

ABSTRACT: In earlier parts (Refs 1,2) the author established an invariant form of general relationships for propagation of plane monochromatic waves in absorbing crystals and discussed the case of crystals of medium syngonies. The present paper deals with the optical properties of crystals of lower syngonies using a canonical invariant representation of the reciprocal complex tensor of permittivity. General expressions are obtained for polarization of plane waves in crystals of lower syngonies with complex refractive indices for uniform waves. A

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SOV/51-5-3-17/21

Optics of Absorbing Crystals. III. Crystals of Lower Syngonies. Optical Axes.

general expression is found for the special directions which have a single value of the refractive index. The paper is entirely theoretical. There are 2 figures, 1 appendix and 19 references, 14 of which are Soviet, into Russian.

ASSOCIATION: Institut fiziki i matematiki, AN BSSR (Institute of Physics and Mathematics, Academy of Sciences of the Belorussian SSR)

SUBMITTED: October 28, 1957

Card 2/2 1. Crystals--Optical properties 2. Crystals--Theory

AUTHOR: Fedorov, F.I. SOV/51-5-4-14/21

TITLE: Optics of Absorbing Crystals (Optika pogloshchayushchikh kristallov). IV. Classification (IV. Klassifikatsiya).

PERIODICAL: Optika i Spektroskopiya, 1958, Vol 5, Nr 4, pp 450-461 (USSR)

ABSTRACT: The author discusses all possible types of absorbing crystals of lower syngonies from the point of view of the number and nature of the optical axes. It is shown that isotropic optical axes may be present in such crystals. In contrast to transparent crystals the optical properties of absorbing crystals of rhombic, monoclinic and triclinic syngonies differ essentially between each syngony. The total number of various types of absorbing crystals reaches 16, instead of 3, according to Voigt--Drude's theory. Complete classification of absorbing non-active non-magnetic crystals according to their

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Optics of Absorbing Crystals. IV. Classification. SOV/51-5-4-14/21

optical properties is given. The paper is entirely theoretical. There are 9 references, 7 of which are Soviet and 2 German.

ASSOCIATION: Institut fiziki i matematiki, AN SSSR (Institute of Physics and Mathematics, Academy of Science of the U.S.S.R.)

SUBMITTED: October 21, 1957.

Card 2/2

1. Crystals--Optical properties 2. Crystals--Classification 3. Crystals--Theory

AUTHORS: Tomil'chik, L.M. and Fedorov, F.I. SOV/51-5-4-15/21

TITLE: Optics of Absorbing Magnetic Crystals. (Optika pogloshchayushchikh magnitnykh kristallov). I. Polarization of Uniform Plane Waves (I. Polyarizatsiya odnorodnykh ploskikh voln).

PERIODICAL: Optika i Spektroskopiya, 1958, Vol 5, Nr 4, pp 462-468 (USSR)

ABSTRACT: Application of invariant methods (Refs 1-8) simplifies considerably the theory of the optical properties of absorbing crystals. Such a theory is, however, incomplete without allowing for the magnetic properties of crystals. Although in transparent bodies the magnetic susceptibility is negligibly small, it may reach comparatively large values in absorbing crystals. Thus crystalline hydrates of organic and inorganic salts of rare earths and of metals of the iron group (Fe, Ni, Co) are strongly paramagnetic (μ differs from 1 in the third decimal place) and exhibit strong magnetic anisotropy (20% of the absolute value of magnetic susceptibility). There are also many organic and inorganic diamagnetic crystals in which μ differs from 1 only in the fourth or even sixth decimal place but which are nevertheless strongly anisotropic, e.g. graphite. In such substances the magnetic susceptibility and its anisotropy are of the same order as the anisotropy of the permittivity tensor ε. The authors deal with

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SOV/51-5-4-15/21

Optics of Absorbing Magnetic Crystals. I. Polarization of Uniform Plane Waves.

polarization of plane uniform electromagnetic waves propagated in a non-active medium with an arbitrary anisotropy of the dielectric, magnetic and conducting properties. The discussion is given in a general invariant form. The following results are obtained. (1) The most general case of polarization in absorbing crystals is elliptical polarization and the polarization ellipses of the transverse field vectors D! and B are not similar and are not mutually orthogonal. (2) Elliptically polarized waves with similar and identically distributed ellipses of transverse vectors of induction are propagated along optical axes. (3) Circular polarization is possible only for waves propagated along optical axes, and then only in crystals whose parameters obey an additional special relationship involving the permittivity and permeability vectors. (4) Linear polarization of one of the transverse vectors produces linear polarization of the other vector. The paper is entirely theoretical. There are 15 references 8 of which are Soviet, 5 English and 2 translations.

Card 2/2

ASSOCIATION: Belorusskiy gosudarstvennyy universitet im. V.I.Lenina (Belorussian State University imeni V.I. Lenin)

SUBMITTED: October 29, 1957

1. Crystals--Magnetic factors 2. Electromagnetic waves--Polorization

SOV/51-5-5-15/23

AUTHORS: Tomil'chik, L.M. and Fedorov, F.I.

TITLE: Optics of Absorbing Magnetic Crystals. (Optika pogloshchayushchikh magnitnykh kristallov). II. Field Vectors for Plane Waves. Refractive Indices and Optical Axes. (II. Vektory polya ploskikh voln. Pokazateli prelomleniya i opticheskiye osi)

PERIODICAL: Optika i Spektroskopiya, 1958, Vol 5, Nr 5, pp 601-605 (USSR)

ABSTRACT: In Part I (Ref 1) it was shown that the difference between the equations for plane electromagnetic waves in absorbing magnetic crystals and the corresponding equations for transparent magnetic crystals can be reduced to replacement of the real permittivity tensor ε by a complex tensor ε'. Following Refs 2, 3 it is concluded that optical properties of absorbing magnetic crystals should be determined primarily by the tensor $\gamma' = (\varepsilon')^{-1}\mu$. The γ' tensor is in general complex and asymmetric, but it may be made symmetrical using the real symmetric permeability

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Optics of Absorbing Magnetic Crystals. II. Field Vectors for Plane Waves. Refractive Indices and Optical Axes. SOV/51-5-5-15/23

tensor μ. Using a canonical dyad representation for the tensor γ' the authors obtained general invariant expressions which give complex refractive indices and polarization of plane uniform monochromatic waves, as well as the directions of optical axes. The paper is entirely theoretical. There are 8 Soviet references.

SUBMITTED: December 3, 1957

Card 2/2

1. Magnetic crystals--Optical properties 2. Electromagnetic waves --Analysis

24 (5)

AUTHOR: Fedorov, F. I. SOV/56-35-2-25/60

TITLE: Projective Operators in the Theory of Elementary Particles (Proyektivnyye operatory v teorii elementarnykh chastits)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 2, pp 493-500 (USSR)

ABSTRACT: By means of the minimal polynomials of the matrices of the relativistic wave-equation and the spin-matrices projective matrices are written down; dyades are concerned here by means of which every possible particle-state can be described in the case of any spin. The physical fundamental quantities (energy-momentum, current-charge, transition probability) can be represented immediately by means of these projective operators, viz. in an invariant manner (independent of the manner of representation). The calculation of various effects for particles with spin can be reduced to the evaluation of the traces of definite combinations of matrices. In application of the method described the general conditions for the definiteness of energy and charge for

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particles of the same mass are derived. Furthermore, a derivation of the commutation relations for particles with any spin is given. It is shown that the two formulae

$$\tau_{2k} = \alpha_2\beta_k = \pm \Psi_{2k}\cdot\bar{\Psi}_{2k} ; \quad \Psi_{2k}\cdot\bar{\Psi}_{2k} = \pm (\varkappa/\lambda_2^2 p_0^{(2)})\alpha_2\beta_k$$

can be used also for the purpose of dealing with all sorts of other problems in which the spin of particles plays an important part. There are 9 references, 8 of which are Soviet.

ASSOCIATION: Institut fiziki i matematiki Akademii nauk Belorusskoy SSR (Institute of Physics and Mathematics, AS Belorussian SSR)

SUBMITTED: March 26, 1958

24.3200

67211 SOV/58-59-7-16463

Translation from: Referativnyy Zhurnal Fizika, 1959, Nr 7, p 257 (USSR)

AUTHOR: Fedorov, F.I.

TITLE: Reflection and Refraction of Light in Transparent Uniaxial Crystals

PERIODICAL: Uch. zap. Belorussk. un-t, 1958, Nr 41, pp 219 - 230

ABSTRACT: Using the invariance method, the author solved the problem of the reflection and refraction of light in unbounded transparent uniaxial crystals in the case of arbitrary orientation of the optical axis, division plane, and plane of incidence. The resulting formulae for determining the amplitudes of the waves reflected and refracted on a uniaxial crystal have the same value as the Fresnel formulae for isotropic media. The following particular cases are examined: a) the optical axis is parallel to the division plane, b) the optical axis is perpendicular to the division plane, c) the optical axis is arbitrarily oriented relative to the division plane but parallel to the plane of incidence, and d) the normal incidence of light.

Card 1/1

B.V. Bokut'

TOMIL'CHIK, L.M.; FEDOROV, F.I.

Optical characteristics of absorptive magnetic crystals with average and rhombic syngony. Trudy Inst.fiz.i mat. AN BSSR no.3:142-153 '59. (MIRA 13:4)
(Crystals--Optical properties)

MOROZ, L.G.; FEDOROV, F.I.

Wave functions of an electromagnetic field in a vacuum. Trudy Inst.fiz.i mat.AN BSSR no.3:154-166 '59. (MIRA 13:4)

(Wave mechanics) (Electromagnetic waves)

SOV/70-4-4-6/34

AUTHORS: Tomil'chik, L.M. and Fedorov, F.I.

TITLE: Magnetic Anisotropy as a Metric Property of Space

PERIODICAL: Kristallografiya, 1959, Vol 4, Nr 4, pp 498-504 (USSR)

ABSTRACT: It is shown that the theory of the optical properties of homogeneous magnetic crystals can be derived from the corresponding theory for non-magnetic crystals by introducing a metric, the metric tensor g being determined by the magnetic permeability tensor μ . A covariant tensor A is denoted by $\underset{o}{A}$ and a contravariant tensor by $\overset{o}{A}$. $(\underset{o}{g})^{-1} = \overset{o}{g}$. g converts from a space with an orthogonal Euclidean metric to a space with some other metric. In Maxwell's equations E is a covariant vector and B a contravariant pseudovector. As $w = 1/8\pi\,(\bar{E}\bar{D} + \bar{H}\bar{B})$ is scalar, $\bar{D}$ is a contravariant vector and $\bar{H}$ a covariant pseudovector. The refraction m is a covariant vector. In this notation these quantities are denoted by $\underset{o}{\bar{E}}$, $\overset{o}{\bar{B}}$, $\overset{o}{\bar{D}}$, $\underset{o}{\hat{\bar{H}}}$, $\underset{o}{\bar{m}}$.

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SOV/70-4-4-6/34

Magnetic Anisotropy as a Metric Property of Space

The dielectric and magnetic permeabilities are doubly contravariant tensors $\overset{\circ}{\mu}$, $\overset{\circ}{\varepsilon}$. $\wedge$ marks a pseudo-vector. For non-magnetic crystals, Maxwell's equations and the equation for a plane wave take the form:

$$\bar{D} = -[\bar{m}\hat{H}] \; ; \quad \bar{D} = \varepsilon\bar{E} \; ; \quad \hat{B} = [\bar{m}\bar{E}] \; ; \quad \hat{B} = \hat{H} .$$

For a magnetic crystal:

$$\bar{D} = -[\underset{\circ\circ}{\bar{m}\hat{H}}] \; ; \quad \hat{\bar{D}} = \overset{\circ}{\varepsilon}\underset{\circ}{\bar{E}} \; ; \quad \overset{\circ}{\hat{B}} = [\underset{\circ\circ}{\bar{m}\bar{E}}] ; \quad \overset{\circ}{\hat{\bar{B}}} = \mu\hat{\bar{H}} \quad .$$

These quantities are transformed by the metric tensor as:

$$\hat{H} \rightarrow \frac{1}{\sqrt{|\overset{\circ}{g}|}}\underset{\circ}{\hat{\bar{H}}} , \quad [\bar{m}\bar{E}] \rightarrow \sqrt{|\overset{\circ}{g}|}\,[\underset{\circ\circ}{\bar{m}\bar{E}}], \quad \hat{\bar{B}} \rightarrow \sqrt{|\overset{\circ}{g}|}\,\overset{\circ}{\hat{\bar{B}}} \quad .$$

The sets of equations for the two cases can be made to coincide if

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SOV/70-4-4-6/34

Magnetic Anisotropy as a Metric Property of Space

$$\frac{\overset{\circ}{g}}{|\overset{\circ}{g}|} = \overset{\circ}{\mu} \quad \text{or} \quad \overset{\circ}{g} = \frac{\overset{\circ}{\mu}}{\sqrt{|\overset{\circ}{\mu}|}} \quad \text{and} \quad g = \mu_0^{-1}\sqrt{|\overset{\circ}{\mu}|} \ .$$

This statement is proved and two examples are given. There are 9 Soviet references.

ASSOCIATION: Institut fiziki i matematiki AN BSSR (Institute of Physics and Mathematics of the Ac.Sc., Byelorussian SSR)

SUBMITTED: March 22, 1959

Card 3/3

SOV/51-6-1-14/30

AUTHOR: Fedorov, F.I.

TITLE: Theory of the Optical Activity of Crystals. (K teorii opticheskoy aktivnosti kristallov). I. The Law of Conservation of Energy and Optical Activity Tensors (I. Zakon sokhraneniya energii i tenzory opticheskoy aktivnosti)

PERIODICAL: Optika i Spektroskopiya, 1959, Vol 6, Nr 1, pp 85-93 (USSR)

ABSTRACT: This paper gives a phenomenological theory of the optical activity of crystals in an invariant form which is independent of coordinates. Starting from the assumption of independence of the electric and magnetic induction vectors D and B of the gradients of the corresponding fields the author applies the law of conservation of energy to obtain the basic relationship of Born's molecular theory of the optically active crystals. It was found that the vector of the energy flow density in the optically active media differs from the usual Umov--Poynting vector $P = (c/4\pi)[EH]$. This vector is now given by

$$P = (c/4\pi)[EH] - (1/8\pi)(\tilde{\alpha}[E\dot{E}] + \tilde{\beta}[H\dot{H}]),$$

where $\tilde{\alpha}$, $\tilde{\beta}$ are transposes of third-rank tensors α, β, called electric and magnetic activity tensors. The author obtains invariant expressions

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Theory of the Optical Activity of Crystals. 1. The Law of Conservation of Energy and Optical Activity Tensors.

for the activity tensors α and β of all classes of the optically active crystals. Of the 32 classes of crystals the activity tensors become zero for all central and planaxial classes (there are 11 of them) which possess inversion symmetry. Also both inversion classes of hexagonal syngony (with sixth-order inversion axis) and the planar class of cubic syngony have zero activity tensors. Only the remaining classes of crystal symmetry may exhibit optical activity. The paper is entirely theoretical. There are 10 references, 7 of which are Soviet, 1 French, 1 German and 1 translation.

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SOV/51-6-3-15/28

AUTHOR: Fedorov, F.I.

TITLE: On the Theory of Optical Activity of Crystals. II Crystals of Cubic Syngony and Planar Classes of Middle Syngonies (K teorii opticheskoy aktivnosti kristallov. II Kristally kubicheskoy singonii i planal'nykh klassov srednikh singoniy)

PERIODICAL: Optika i Spektroskopiya, 1959, Vol 6, Nr 3, pp 377-383 (USSR)

ABSTRACT: The author showed that Maxwell's equations together with constitutive equations for plane waves in optically active media have the following form:

$$\vec{D} = -[\vec{m}\vec{H}], \quad (1)$$

$$\vec{B} = [\vec{m}\vec{E}], \quad (2)$$

$$\vec{D} = \varepsilon\vec{E} + ik[\alpha\vec{m}, \vec{E}], \quad (3)$$

$$\vec{B} = \mu\vec{H} + ik[\beta\vec{m}, \vec{H}], \quad (4)$$

where $\vec{m} = n\vec{n}$ is the refraction vector, $k = \omega/c$ is the wave number in vacuum and α, β are the electric and magnetic activity tensors respectively. Using Eqs.(1)-(4)

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On the Theory of Optical Activity of Crystals. II Crystals of Cubic Syngony and Planar Classes of Middle Syngonies

the author studied propagation of light in anisotropic media with the highest symmetry, i.e. in crystals of cubic syngony and planar classes of middle syngonies. As in the preceding paper (Ref.1), invariant treatment was employed. The author found that in planar classes of middle syngonies there is no rotation of the plane of polarisation on propagation of light along the optical axes. Nevertheless properties of such crystals differ essentially from properties of optically inactive crystals, since the light reflected at such crystals is elliptically polarised. The author points out that optically active substances do not necessarily exhibit the property of rotation of the plane of polarisation. He proposes that a medium should be called optically active if its constitutive equations have the form

$$\vec{D} = \varepsilon\vec{E} + [\alpha\nabla, \vec{E}], \quad \vec{B} = \mu\vec{H} + [\beta\nabla, \vec{H}] \qquad (45)$$

Card 2/3 For plane waves these equations have the form given by

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On the Theory of Optical Activity of Crystals. II Crystals of Cubic Syngony and Planar Classes of Middle Syngonies

Eq.(3)-Eq.(4) with α and β not equal to zero. From this definition it follows that a medium which rotates the plane of polarisation for one or more directions of propagation of light is necessarily an optically active medium, but, in general, the reverse is not true. The paper is entirely theoretical. There are 8 references, of which 6 are Soviet, 1 translation from German into Russian and 1 German.

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24(4), 24(2)

SOV/51-6-4-21/29

AUTHORS: Bokut', B.V. and Fedorov, F.I.

TITLE: On the Theory of the Optical Activity of Crystals. (K teorii opticheskoy aktivnosti kristallov). III. The General Equation of Normals (III. Obshcheye uravneniye normaley)

PERIODICAL: Optika i Spektroskopiya, 1959, Vol 6, Nr 4, pp 537-541 (USSR)

ABSTRACT: In the earlier parts of this work (Refs 1, 2) the author developed an invariant phenomenological theory on the optical activity of crystals of all types of symmetry. The present paper deals with the general equation of normals for the optically active crystals when magnetic effects are allowed for. The theory shows that three types of waves are possible in the optically active crystals, and the phase velocity of the third wave should be very small compared with the velocity of light. The paper is entirely theoretical. There are 6 references, 5 of which are Soviet and 1 translation from German into Russian.

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SOV/51-7-4-20/32

AUTHORS: Bokut', B.V. and Fedorov, F.I.

TITLE: Propagation of Light in Absorbing Magnetic Active Isotropic Media and Cubic Crystals

PERIODICAL: Optika i spektroskopiya, 1959, Vol 7, Nr 4, pp 558-561 (USSR)

ABSTRACT: The authors discuss propagation of plane electromagnetic waves in an optically isotropic medium, possessing optical absorption, optical activity and magnetic properties. It is shown that when the magnetic terms of the optical activity are taken into account, circular dichroism should occur. The paper is entirely theoretical. There are 8 references, 6 of which are Soviet and 2 translations.

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LOBKO, S.I.; FEDOROV, F.I.

Spin 1/2 - 3/2 particle in a homogeneous magnetic field.
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1. Belorusskiy gosudarstvennyy universitet im. V.I.Lenina.
(Particles (Nuclear physics))